# Atomic Pair Distribution Function (PDF) And X-Ray Scattering Methods To Assess Amorphous Organic Compounds

Detlef Beckers, Milen Gateshki, Malvern Panalytical B.V., Almelo, The Netherlands
detlef.beckers@malvernpanalytical.com

The amorphous state is of significant interest as a possible means to enhance aqueous solubility of APIs. Either by spray drying the API itself or creating solid dispersions of the API with different polymers. Often the short-range structural arrangement directly determines the physical stability of the pharmaceutical solid.

An important practical barrier to the development of amorphous APIs for drug products is the lack of reliable methods for structural characterization and fingerprinting. The Atomic Pair distribution function (PDF) have been suggested as an alternative approach for fingerprinting of amorphous materials and to study the short range order (i.e. inter-atomic distances) of the material. The PDF technique utilizes a Fourier transformation of the X-ray powder diffraction (XRPD) data and gives information about the inter-atomic distances of the material. The accuracy of this assessment of inter-atomic distances depends strongly on the energy of the utilized radiation source.

Recent advances in laboratory X-ray diffractometer technology like e.g. new generation detectors optimized for hard radiation (like Mo and Ag radiation) allow to minimize artifacts or fluctuations in the PDF arising from statistical noise, resulting in more reliable data. Thus, the amorphous and nanocrystalline materials in the drugs can be studied reliably in the laboratory. We will demonstrate the possibilities of laboratory PDF on a variety of organic samples of different nature. And show with cluster analysis that PDF patterns can reliably be used for fingerprinting of amorphous drugs and drug compounds.